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PUBLIC HEALTH REPORTS.

UNITED STATES.

[Reports to the Surgeon-General, Public Health and Marine-Hospital Service.]

Report from Charlotte, N. C.—Investigation of enteric fever.

Passed Assistant Surgeon Anderson reports, July 17, 1906, as follows on the outbreak of enteric fever at Charlotte, N. C., the investigation having been undertaken under Bureau instructions issued July 2, 1906, on request made for special reasons by the State board of health of North Carolina:

Upon arrival in Charlotte, in obedience to my instructions, I called upon Doctor Hawley, the city physician, but was informed by him that the proposed investigation was not on account of enteric fever in the city of Charlotte, but of an outbreak of fever in Elizabeth Seminary, situated in the environs of the city. I then met the principal of the school, the school physician, and two members of the board of trustees, and Mr. W. W. Locke, of the Metropolitan Water Board, Boston, Mass., who had been engaged by the school to investigate the outbreak of fever in Elizabeth Seminary.

This seminary is situated on one of the hills by which the city is partly surrounded. The college buildings were erected in 1899, and, as far as I was able to learn, modern ideas in regard to construction, plumbing, etc., were followed. The dining room, kitchen, and other rooms where food is kept are well screened from flies and kept clean. The water supply is from the city mains. The milk supply up to April 19 was from cows kept at the school, but from that date until the closing of the school, May 22, an additional supply was obtained from the Watkins dairy, from 1 to 3 gallons being received daily. Ice cream was obtained at various times from Brannon, a dealer in Charlotte. Brannon obtained his milk supply from Dotger's and Kirkpatrick's dairies.

Elizabeth Seminary had, during the past session, 180 pupils and teachers; of these, 92 boarded in the college. Doctor King, the principal, had 8 in his family; he lived in a separate house and had the same water, ice, and food, with the exception of the Watkins milk, as the school. His meals were prepared in his own house. There were 24 servants employed in the buildings.

From May 10 to 20 the school physician reports 33 cases of enteric fever among the pupils and teachers; from the infirmary records I think we can be sure that 17 only were genuine enteric, the other cases having a duration of less than a week, some as short as four days. No case occurred in the principal's family and none among the servants, who were all negroes. So far as could be determined none of the day scholars, about 88 in number, developed enteric fever during this time.

In the city of Charlotte there is a good deal of enteric fever; just how much I am not able to say, as there are no requirements compelling the reporting of enteric fever; 50 cases were reported for the month of June, and 38 cases were reported under treatment during the week ended July 4, but I think double this number would not be too large an estimate.

Two main causes operate for the prevalence of enteric fever in the city itself: 1. The city water supply; 2, the large number of wells.

I made no attempt to investigate the second cause, but paid considerable attention to the city water supply. This supply is derived from a watershed about 5 miles square; the water from the shed is collected in a reservoir, where partial sedimentation takes place, and is passed through a mechanical filter, thence pumped into a standpipe, and from there distributed throughout the city. There are about 40 families living on the watershed. Three dairies, containing about 100 cows, are also on the watershed. At the present time there are two undoubted cases of enteric fever, and possibly a third one convalescent, among those living on the watershed. One of these cases which I saw is within a mile of the reservoir.

The flow of water into the reservoir is very rapid, resulting in the quick washing by rain of material deposited on the ground into the reservoir. These cases of enteric fever on the watershed are a serious menace to the city water supply, and some means should be found to bring about their removal.

The water, after passing through the filtration plant, is almost colorless, but a recent examination of it by Penniman and Browne, of Baltimore, showed the presence of *B. coli*.

There are no proper examinations made of the raw and filtered water to determine just what the plant is doing. It is plain that there is no scientific control of the filtration system, without which no filtration system can give satisfactory results.

Other than the two main sources of infection in the city are the ice, milk, contacts, flies, fresh vegetables, and fruits such as berries. Up to June 1 the ice plant obtained its water from an abandoned mine shaft, which is so situated as to receive the drainage of a number of houses and factories. The manager of the ice plant claims that all the water used for making ice is distilled, but it has been my experience with ice manufacturers that at times when the supply of distilled water runs low plain water is also used.

There are many dairies supplying milk in the city. Time did not permit me to visit all of them. I visited Watkins's, Dotger's, and Culp's. The water at the Watkins dairy is from a spring or a number of springs. Two families reside near this spring, and it would be easy for surface drainage to get into it. As the additional source of milk supply for Elizabeth College, which was first obtained April 19, was from this dairy, I examined into its methods, water, and general conditions at some length. I was unable to learn of any case of sickness among the employees or persons living on the farm. So far as I was able to learn, it was not the custom to sterilize the returned milk cans and bottles; they were simply washed out with warm water and soap and then rinsed out with cold water which was obtained from a well of the spring water outside the washing room or from the troughs in which the milk cans are kept in the washing room. This last practice seemed to me to be particularly pernicious; for if a returned milk bottle from a house in which there was enteric fever should be infected by any means, it would be possible in rinsing this bottle in the bucket which was used to dip up the water to infect many other bottles and the water in the troughs or well of spring water. It certainly would seem that all milk cans and bottles should be sterilized before being used a second time.

A visit was made to what is known as the "upper" Watkins farm, which supplies part of the Watkins milk. The water supply here is a surface well about 15 feet deep; near the well is a negro cabin in which at the time of my visit was a child who had been sick several days. Clinically the case seemed to be enteric fever. There was no privy, and the dejecta could easily drain into the shallow well. The well supplied water for washing the cans and cooling the milk.

In view of the fact that the college first began to get milk from the Watkins dairy on April 19, or just twenty-one days before the first case of fever developed there, and that no case occurred in the family of the principal, who had the same water and food supply but not the milk from this dairy, I am inclined to regard the Watkins dairy milk as a very probable source of infection for the college.

Moreover, the Presbyterian College for Women had 112 boarding pupils who used the same water supply as Elizabeth College, but a different milk supply, and, except for 1 case of enteric fever, which from the history probably did not originate in Charlotte, had no fever this spring. This probably excludes the city water as the cause of the outbreak of 17 cases in Elizabeth College.

A rather general impression prevailed in certain quarters that the plumbing of the college was the cause of the fever, but it is generally accepted among sanitarians that defective plumbing of itself can not cause enteric fever; besides, I consider the plumbing in good condition and believe that it had absolutely nothing to do with the outbreak of fever.

A partial chemical examination was made by Doctor Kastle, chief of division of chemistry, of the filtered city water and of the water from the tap in the cooling room at Watkins's dairy. This examination, in connection with the bacteriologic examination, shows that the city water is bad. The chlorine, nitrates, and nitrites of the Watkins water are high and the water chemically as well as bacteriologically is unfit for drinking purposes.

BACTERIOLOGICAL EXAMINATION.

Samples of water were taken from various places, placed on ice, and brought to the hygienic laboratory for study. These samples were taken from places which appeared to have more or less connection with the outbreak in Elizabeth Seminary. Thirteen samples in all were taken from the following places:

No. 1.—City tap water, Elizabeth Seminary. *No. 2.*—Tap in cooling room of Watkins's dairy. *No. 3.*—Well of spring water outside washing room, Watkins's dairy. *No. 4.*—Trough for milk cans in washing room, Watkins's dairy. *No. 5.*—Well water, Culp farm. *No. 6.*—Well water, Dotger's dairy. *No. 7.*—Well water, lower Watkins farm. *No. 8.*—Mine shaft near ice factory. *Nos. 9, 10, and 11.*—Filtered water, filtration plant. *No. 12.*—Raw or unfiltered city water. *No. 13.*—City water at Doctor Bland's house.

Samples Nos. 3, 4, and 10 were not studied in detail as were other samples from practically the same source.

Sample number.	Source of water.	Number bacteria per c.c.	Minimum quantity producing gas in lactose bouil. at 42° C.	Presumptive test for B. coli.	Diagnostic tests for B. coli.								
					Morphology.	Grams.	Motility.	Gelatine liquefaction.	Gas in lactose broth.	Milk coagulated and acid produced.	Indol test.	Nitrates reduced.	B. coli.
			c. c.										
1	City water, Elizabeth College.	100	1.0	+	Rod	—	Slight ..	–	+	+	+	+	Yes.
2	Tap in cooling room, Watkins dairy.	1,800	0.1	+	Rod	—	Slight ..	–	+	+	+	+	Yes.
3	Well of spring water, Watkins dairy.	7,000	0.1	+	......	....	....	....	....	....	....	....	......
4	Trough for milk cans, Watkins dairy.	9,000	0.1	+	......	....	....	....	....	....	....	....	......
5	Well at Dotger's dairy........	100	10.0	+	Rod	—	Slight ..	–	+	+	+	+	Yes.
6	Well at Culp's dairy..........	40	10.0	+	Rod	—	Slight ..	+	+	+	+	+	?
7	Well at lower Watkins farm .	12,000	0.1	+	Rod	—	Slight ..	–	+	+	+	+	Yes.
8	Old mine shaft near ice plant.	8,000	0.1	+	Rod	—	Slight ..	–	+	+	+	+	Yes.
9	Filtered-water gallery, filtration plant.	800	1.0	+	Rod	—	Slight ..	....	+	+	+	+	Yes.
10	.....do......................	700	1.0	+	Rod	—	Slight ..	–	+	+	+	+	Yes.
11	.....do......................	....	1.0	+	......	....	....	....	....	....	....	....	......
12	Unfiltered city water.........	6,000	0.1	+	Rod	—	Slight ..	–	+	+	+	+	Yes.
13	City tap water, Dr. Bland's house.	100	10.0	+	Rod	—	Slight ..	–	+	+	+	+	Yes.

An examination of the above table shows that the colon bacillus was isolated in pure culture from all of the samples studied except No. 6, which was doubtful. All of the samples showed the "presumptive test for *B. coli.*" Samples of city water showed *B. coli* in as small as 1 c. c.; the unfiltered city water in 0.1 c. c.

All the samples from Watkins's dairy spring-water well and from the well at the lower farm showed *B. coli* in as small amounts as 0.1 c. c. The Culp and Dotger water showed *B. coli* in 10 c. c.

CONCLUSIONS.

From the foregoing the following conclusions may be drawn:

1. That an efficient daily patrol of the watershed should be made in order to detect cases of illness, especially enteric fever.
2. Some means should be provided by which all cases of enteric fever occurring on the watershed could be removed so as no longer to be a source of danger to the city water supply.
3. Practically the entire water supply of the city of Charlotte is infected.
4. The filtration plant removes only about 88 per cent of the bacteria.
5. The filtration plant is conducted in an unscientific and faulty manner.
6. There is urgent need of a competent biologist and chemist to make a thorough study of the wells used for drinking water in the city of Charlotte.

7. A daily examination of the raw and filtered water should be made.

8. All infected or suspicious wells and springs should be closed against use for all purposes.

9. The ice factory should be prohibited from using water from the old mine shaft.

10. On account of the fact that the water of certain dairies was found to contain colon bacilli, dairymen should be required to sterilize all milk cans and bottles; these are used for fresh milk.

11. On account of the great lapse of time it is impossible to say definitely where the infection of the 17 cases at Elizabeth Seminary originated, but it was very probably in the additional supply of milk which was first used at the college twenty-one days before the outbreak of the fever.

12. Elizabeth College should have a sufficient number of cows to supply milk for all its purposes.

13. All the water used for drinking purposes in the college should be boiled.

14. No ice used at the college should be put in the water or milk; these articles can be cooled by being put on ice or in some other satisfactory manner.

15. In my opinion, the outbreak of fever at Elizabeth College was not due to defective plumbing, as some persons claimed, nor was it due to any negligence on the part of the college authorities, and it could not have been avoided without biologic examination of the college supplies.

16. Patrons of the school should have no hesitancy in sending their daughters to Elizabeth College for the ensuing session, provided the above suggestions are carried out.

Report from Baltimore, Md.—Smallpox on steamship Neckar from Bremen—Vessel fumigated.

Passed Assistant Surgeon Stansfield, in temporary charge, reports, August 8, as follows:

The steamship *Neckar* arrived at Baltimore August 6, from Bremen, with one case of smallpox in the steerage. The case was removed and placed in quarantine, the personnel of the vessel vaccinated and allowed to land, and such parts of the vessel as were thought infected were fumigated.

This action was taken by the local quarantine authorities.

Report from Bismarck, N. Dak.—Enteric fever on river steamer Expansion—Precautions against infection of Yellowstone River.

Acting Assistant Surgeon Smyth reports, August 6, as follows:

Within the past month 4 cases of enteric fever were received at this station from the steamer *Expansion*, engaged in local traffic on the Yellowstone River, near Glendive, Mont.

This vessel is engaged in carrying supplies and material to the different camps on an irrigating canal, at present being constructed by the General Government, and I am informed that from 1,000 to 2,000 men are constantly on the irrigation works, divided into camps of from 100 to 200 men. The sanitary conditions in the camps are said to be